Evaluating Trigonometric Functions

Name: ______________	Date: ______________	Score: ______ / 29

Quick Review

This section pulls everything together: given any angle (degrees or radians, positive or negative) and any of the six trig functions, find the exact value.

Three tools, used in this order.

1) *Reference-angle method* for non-quadrantal angles: reduce to $[0, 360°)$, find the quadrant and reference angle, look up the special-angle value, apply the quadrant sign.

2) *Unit-circle method* for quadrantal angles ($0, 90, 180, 270$ in degrees, or $0, \frac{\pi}{2}, \pi, \frac{3\pi}{2}$ in radians): read $\cos\theta$ and $\sin\theta$ directly off the unit-circle coordinates.

3) *Terminal-point method* for angles given by a point (x, y): with $r = \sqrt{x^2 + y^2}$, $\sin\theta = \frac{y}{r}$, $\cos\theta = \frac{x}{r}$, $\tan\theta = \frac{y}{x}$.

Even/odd properties. Sine and tangent are *odd*: $\sin(-\theta) = -\sin\theta$, $\tan(-\theta) = -\tan\theta$. Cosine is *even*: $\cos(-\theta) = \cos\theta$. These let you handle negative angles without first finding a coterminal positive one.

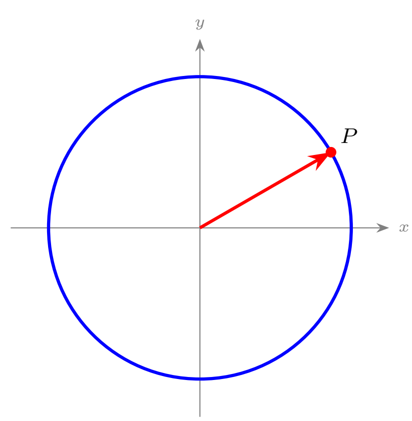
Periodicity. Sine, cosine, secant, and cosecant repeat every $360°$ (or 2π): $\sin(\theta + 360°) = \sin\theta$. Tangent and cotangent repeat every $180°$ (or π): $\tan(\theta + 180°) = \tan\theta$.

Common slips. Forgetting that $\tan$ has period $180°$, not $360°$ – it makes shortcuts easier. Mixing up which trig function is even vs odd. Treating $\tan 90°$ as zero (it's undefined: cosine is zero there).

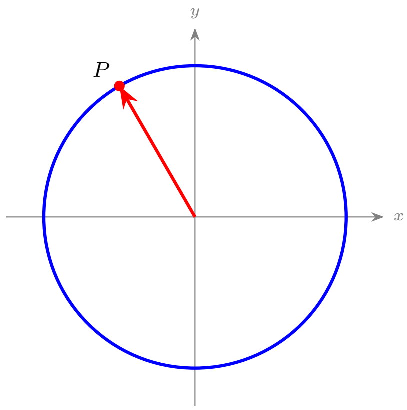
PRACTICE

Find exact values. Use reference angles, the unit circle, or terminal points as appropriate.

1. Evaluate $\sin\left(\frac{\pi}{6}\right)$ for the angle drawn below. ________



2. Evaluate $\cos\left(\frac{2\pi}{3}\right)$ for the angle drawn below. ________



3. $\tan\left(\frac{5\pi}{4}\right)$. ________

4. $\sin\left(-\frac{\pi}{3}\right)$. ________

5. $\sec\left(\frac{7\pi}{6}\right)$. ________

6. $\sin^2\left(\frac{\pi}{4}\right) + \cos^2\left(\frac{\pi}{4}\right)$. ________

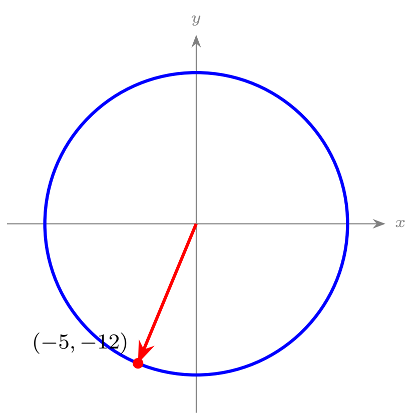
7. $\sin\left(-\frac{\pi}{2}\right)$. ________

8. $\cos\left(\frac{5\pi}{6}\right)$. ________

9. $\tan\left(\frac{4\pi}{3}\right)$. ________

10. $\csc\left(\frac{3\pi}{2}\right)$. ________

11. For the angle θ drawn below (terminal side through $(-5, -12)$), find $\sin\theta$. ________



12. For θ in standard position with terminal side through $(-5, -12)$, find $\cos\theta$. ________

13. Evaluate exactly: $2\cos\frac{\pi}{3} - \tan\frac{3\pi}{4}$. ________

14. $\sin 390°$. ________

15. $\cos(-60°)$. ________

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16. $\tan(-\frac{\pi}{4})$. ________

17. $\sin 405°$. ________

18. $\cos\left(\frac{11\pi}{6}\right)$. ________

19. $\sec 0°$. ________

20. $\cot\frac{\pi}{2}$. ________

♦ Word Problems

21. A point P on the terminal side of an angle θ in standard position has coordinates $(-3, 4)$. Find $\sin\theta$, $\cos\theta$, and $\tan\theta$ exactly. ____

22. Evaluate exactly: $\sin\frac{5\pi}{4} + \cos\frac{5\pi}{4}$. ____

23. Find $\tan 765°$ exactly. (Hint: tangent has period $180°$.) ____

24. For an angle θ with $\sin\theta = -\frac{3}{5}$ and θ in Q4, find $\cos\theta$ and $\tan\theta$ exactly. ____

Additional Practice

25. Find $\sin\theta$ if opposite $= 5$, hypotenuse $= 13$. ________

26. Find $\cos\theta$ if adjacent $= 12$, hypotenuse $= 13$. ________

27. Find $\tan\theta$ if opposite $= 7$, adjacent $= 4$. ________

28. Find $\sin 30°$. ________

29. Find $\cos 60°$. ________

Answer Keys

1. $\boxed{\frac{1}{2}}$
2. $\boxed{-\frac{1}{2}}$
3. $\boxed{1}$
4. $\boxed{-\frac{\sqrt{3}}{2}}$
5. $\boxed{-\frac{2\sqrt{3}}{3}}$
6. $\boxed{1}$
7. $\boxed{-1}$
8. $\boxed{-\frac{\sqrt{3}}{2}}$
9. $\boxed{\sqrt{3}}$
10. $\boxed{-1}$
11. $\boxed{-\frac{12}{13}}$
12. $\boxed{-\frac{5}{13}}$
13. $\boxed{2}$
14. $\boxed{\frac{1}{2}}$
15. $\boxed{\frac{1}{2}}$
16. $\boxed{-1}$
17. $\boxed{\frac{\sqrt{2}}{2}}$
18. $\boxed{\frac{\sqrt{3}}{2}}$
19. $\boxed{1}$
20. $\boxed{0}$
21. $\boxed{\sin\theta = \frac{4}{5},\ \cos\theta = -\frac{3}{5},\ \tan\theta = -\frac{4}{3}}$
22. $\boxed{-\sqrt{2}}$
23. $\boxed{1}$
24. $\boxed{\cos\theta = \frac{4}{5},\ \tan\theta = -\frac{3}{4}}$

Additional Practice Answers

25. $\boxed{\frac{5}{13}}$
26. $\boxed{\frac{12}{13}}$
27. $\boxed{\frac{7}{4}}$
28. $\boxed{\frac{1}{2}}$
29. $\boxed{\frac{1}{2}}$

Additional Practice: Answers for all numbered items, including the added practice, are shown in the grid above.

Step-by-Step Explanations

1. A careful way to see it: $\frac{\pi}{6} = 30^\circ$. Special-angle value. This is the part to check before moving on, because it keeps the answer tied to the original question.

2. Keep the rule visible: $\frac{2\pi}{3} = 120^\circ$, Q2, reference $\frac{\pi}{3}$, cosine negative. This is the part to check before moving on, because it keeps the answer tied to the original question.

3. One steady path is: $\frac{5\pi}{4} = 225^\circ$, Q3, reference $\frac{\pi}{4}$, tangent positive. This is the part to check before moving on, because it keeps the answer tied to the original question.

4. Start with the key idea: Sine is odd: $\sin(-\theta) = -\sin\theta$. $-\sin\frac{\pi}{3} = -\frac{\sqrt{3}}{2}$. This is the part to check before moving on, because it keeps the answer tied to the original question.

5. A careful way to see it: $\frac{7\pi}{6} = 210^\circ$, Q3, $\cos = -\frac{\sqrt{3}}{2}$. $\sec = \frac{1}{\cos} = -\frac{2}{\sqrt{3}} = -\frac{2\sqrt{3}}{3}$. This is the part to check before moving on, because it keeps the answer tied to the original question.

6. Keep the rule visible: Pythagorean identity – equals 1 for every angle where both are defined. That gives a quick check on the answer.

7. One steady path is: Sine is odd, and $\sin\frac{\pi}{2} = 1$, so $\sin\left(-\frac{\pi}{2}\right) = -1$. (Or: the point at -90° is $(0, -1)$.) That gives a quick check on the answer.

8. Start with the key idea: $\frac{5\pi}{6} = 150^\circ$, Q2, reference $\frac{\pi}{6}$, cosine negative. This is the part to check before moving on, because it keeps the answer tied to the original question.

9. A careful way to see it: $\frac{4\pi}{3} = 240^\circ$, Q3, reference $\frac{\pi}{3}$, tangent positive (both sin and cos negative in Q3). That gives a quick check on the answer.

10. Keep the rule visible: $\sin\frac{3\pi}{2} = -1$ (point $(0, -1)$), so $\csc = \frac{1}{-1} = -1$. This is the part to check before moving on, because it keeps the answer tied to the original question.

11. One steady path is: $r = \sqrt{25 + 144} = 13$. $\sin\theta = \frac{y}{r} = -\frac{12}{13}$. This is the part to check before moving on, because it keeps the answer tied to the original question.

12. Start with the key idea: Same triangle: $\cos\theta = \frac{x}{r} = -\frac{5}{13}$. This is the part to check before moving on, because it keeps the answer tied to the original question.

13. A careful way to see it: $\cos\frac{\pi}{3} = \frac{1}{2}$ and $\tan\frac{3\pi}{4} = -1$ (Q2, reference $\frac{\pi}{4}$, tangent negative). So $2(\frac{1}{2}) - (-1) = 1 + 1 = 2$. That gives a quick check on the answer.

14. Keep the rule visible: Period of sine is 360°: $\sin 390^\circ = \sin 30^\circ = \frac{1}{2}$. This is the part to check before moving on, because it keeps the answer tied to the original question.

15. One steady path is: Cosine is even: $\cos(-60^\circ) = \cos 60^\circ = \frac{1}{2}$. This is the part to check before moving on, because it keeps the answer tied to the original question.

16. Start with the key idea: Tangent is odd: $\tan(-\frac{\pi}{4}) = -\tan\frac{\pi}{4} = -1$. This is the part to check before moving on, because it keeps the answer tied to the original question.

17. A careful way to see it: $\sin 405^\circ = \sin(405^\circ - 360^\circ) = \sin 45^\circ = \frac{\sqrt{2}}{2}$. This is the part to check before moving on, because it keeps the answer tied to the original question.

18. Keep the rule visible: $\frac{11\pi}{6} = 330^\circ$, Q4, reference $\frac{\pi}{6}$, cosine positive. This is the part to check before moving on, because it keeps the answer tied to the original question.

19. One steady path is: $\cos 0^\circ = 1$, so $\sec 0^\circ = 1$. This is the part to check before moving on, because it keeps the answer tied to the original question.

20. Start with the key idea: $\cot\theta = \frac{\cos\theta}{\sin\theta}$. At $\frac{\pi}{2}$: $\cos = 0, \sin = 1$. So

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$\cot = \frac{0}{1} = 0$. This is the part to check before moving on, because it keeps the answer tied to the original question.

21. A careful way to see it: $r = \sqrt{9+16} = 5$. So $\sin\theta = \frac{y}{r} = \frac{4}{5}$, $\cos\theta = \frac{x}{r} = -\frac{3}{5}$, $\tan\theta = \frac{y}{x} = \frac{4}{-3} = -\frac{4}{3}$. (Q2: sine positive, cosine negative, tangent negative – matches the ASTC sign rules.) That gives a quick check on the answer.

22. Keep the rule visible: $\frac{5\pi}{4} = 225°$, Q3, reference $\frac{\pi}{4}$. Both sine and cosine are negative in Q3. $\sin\frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$, $\cos\frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$. Sum: $-\frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2} = -\sqrt{2}$. That gives a quick check on the answer.

23. Reduce using tangent's $180°$ period: $765 = 4(180) + 45$, so $\tan 765° = \tan 45° = 1$. (Cross-check with $360°$ period: $765 - 2(360) = 45$, and $\tan 45° = 1$ ✓.)

24. From $\sin^2\theta + \cos^2\theta = 1$: $\cos^2\theta = 1 - \frac{9}{25} = \frac{16}{25}$, so $\cos\theta = \pm\frac{4}{5}$. Q4 has cosine positive, so $\cos\theta = \frac{4}{5}$. Then $\tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{-3/5}{4/5} = -\frac{3}{4}$.

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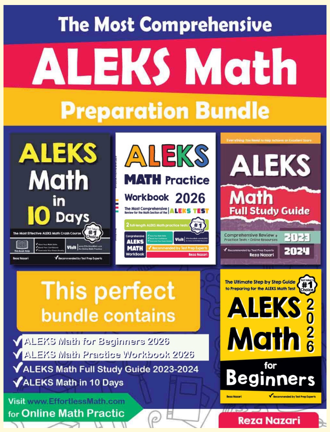

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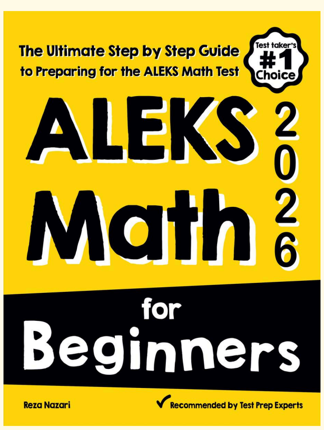

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